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ABSTRACT

Investigated with 737 first grade students and 175 educable mentally retarded children (CA=6 to 18, MA=6 to 7 years) in special classrooms were the differences found in teacher's ratings of their students' mathematical abilities with regard to expectancy bias. Scores on the Peabody Mathematics Readiness Test were compared with ratings given by 34 first grade and 45 special education teachers. The comparative results indicated that teachers of the mentally retarded Ss consistently rated their students lower on mathematical abilities than their first grade counterparts. (IM)

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The Peabody Mathematics Readiness Test: Investigations with Mentally Retarded Children (B.) PMRT and Teacher Ratings

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Abstract

This investigation analyzed the differences found in teacher's ratings of their students mathematical abilities with regard to expectancy biases. The samples involved 737 first grade and 175 mentally retarded subjects, who had all participated in standardization research of the Peabody Mathematics Readiness Test (PMRT). The teachers ratings had been given by 34 first grade and 45 special education teachers. The teacher's ratings were statistically compared by overall means, individual chi-squares, percentile ratings and class size. The comparative results found that teachers of the mentally retarded subjects had consistently rated their students lower on mathematical abilities than their first grade counterparts. While teacher expectancy biases were a possibility, the results were discussed with particular regard to the study's limitations.

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The Peabody Mathematics Readiness Test

Investigations with Mentally Retarded Children

(B.) PMRT and Teacher Ratings

The evaluation and grading of student progress is a major aspect of the teachers job. Kirschenbaum, Simon & Napier (1971) have st ted that the whole idea of grading has been one of the most controversial topics in American education. Good & Brophy (1977) have pointed out that grading and evaluation, although an unpleasant aspect of teaching, is still very necessary in terms of society's "external pressures." They state that external pressures consist of such factors as: citizen and state educational agencies interest in school quality; decision-making in higher educational advisement; and potential employer information purposes. Chansky (1962) has said that grades are seen by many educators as motivators, but most are used to categorize students administratively. Unfortunately, most educational administrative categorizations have tended to revolve around ability groupings.

During the past decade, a plethora of research has focused upon the effects of categorizing students. Within the area of special education, the categorization process has come under considerable scrutiny (Blatt, 1972, Clark, 1969; Dunn, 1968; Edgarton, 1967; Gallagher, 1972; Hammons, 1972; Jones, 1972, Lilly, 1971; Meyen, 1971; Reynolds & Balow, 1972; Smith & Neisworth, 1977). Foster, Ysseldyke & Reese (1975) have stated that some of the most persuasive evidence against the process of categorizing students has been that it produces adverse effects on teacher expectations, which causes

self-fulling prophecies. In their controversial study, Rosenthal & Jacobson (1968) described a self-fulfilling prophecy as "how one person's expectation for another person's behavior can quite unwittingly become a more accurate prediction simply for its having been made" (p. vii). While most attempts at replicating Rosenthal & Jacobson's (1968) research have proven fruitless (Claiborn, 1961; Dusek & O'Connell, 1973; Gozali & Meyen, 1970; Jose & Cody, 1971; Soule, 1972) the concepts of teacher expectation and self-fulfilling prophecy have been empirically established. Good & Brophy (1977) state that "in the past five years work by a large number of investigators using a variety of methods has established unequivocally that teachers expectations can and do function as self-fulfilling prophecies. (For extended reviews of this research see Braun, 1976; Braun, Neilsen & Dyksta, 1975; Brophy & Good, 1974; Dusek, 1975; Finn, 1972)" (p. 383).

Investigations studying the effects of teacher expectations on the performance of students labeled as mentally retarded have found mixed results. Some studies (Beez, 1970; Rothbart, Dalfen & Barrett, 1971; Rubovits & Maehr, 1971; Smith & Greenberg, 1975) have confirmed that expectancy biases due to categorization do exist. Other studies (Gozali & Meyen, 1970; Yoshida & Meyers, 1975) have not found conclusive evidence to support that permise. These studies have found that such factors as student behavior, student-teacher interaction, teacher's role and teacher's experience are more influencial. Foster et al. (1975) have shown that special education training institutions through lectures, discussions and assigned readings might be unwittingly exposing students to expectancy biases. It does stand to reason that if people are especially

trained to look for something, they will find it! Yoshida & Meyers (1975) in discussing educational placement have stated that, "it has become clear that any child identified as 'retarded' invokes stereotypes and attitudes in lay persons and professionals alike, these tendencies being no doubt due in part to knowledge of the characteristics of the more seriously retarded children who are marked by obvious deviant bodily and behavioral stigma than the all-but-normal EMR children" (p. 522).

The purpose of this study was to elaborate this course of investigation by analyzing the significant differences found between teachers ratings of mathematical abilities for first grade and mentally retarded children. The teachers ratings had been initally obtained from a previous investigation (Richardson, Thurman, & Bassler, 1977) which had compared the performance of first grade and mentally retarded children on the Peabody Mathematics Readiness Test (PMRT). The PMRT[1] (Bassler, Beers & Richardson, 1973) had been developed to assess mathematical readiness skills and identify children who would experience difficulties in first grade mathematics. Previous research (Beers, 1973) using the PMRT had shown that children identified with this diagnostic tool have benefited from specific skill remediation. Richardson's et al. (1977) comparative investigation found that while the PMRT had very good utility with mentally retarded children, significant differences between the two samples still existed in two areas. One of those areas was the teacher's ratings of the subjects mathematical abilities. The intent of this study was to conduct a post hoc investigation to explore that significant difference in an attempt to determine the reason(s) for the lower ratings given by teachers to the mentally retarded sample.

Method

Subjects

The subjects were 737 first grade and 175 mentally retarded children. The first grade sample consisted of students from 34 various classrooms taken from areas within four different states. The geographic locales for the sample involved urban, suburban and rural school settings. The four states involved were Louisiana, Missouri, New York, and Tennessee. The mentally retarded sample was taken from 45 different classroom settings within one large midwestern metropolitan area.

The mentally retarded subjects were all selected for this sample on specific criteria. The criteria was an IQ range between 50 and 75 ($\bar{X}$ = 60.38) and MA between 6-0 years and 6-11 years ($\bar{X}$ = 6-6 years). The subjects chronological ages ranged from 6-3 years to 18-1 years ($\bar{X}$ = 10-7 years) and the sample's sex distribution was 85 males and 90 females. The tests used to determine the IQ and MA were the Stanford-Binet and WISC. This investigation has presupposed that the MA criteria for the mentally retarded subjects would be comparative to first grade ability levels. All of the mentally retarded subjects were in special EMR classrooms. Because of the selection criteria, no one EMR classroom contained an entire class of subjects for this investigation. The number of mentally retarded subjects selected from any one classroom teacher ranged from thirteen (13) to one (1) per class, with a mean class size of 3.84.

The first grade subjects consisted of 288 male and 259 females (sex distribution data was unavailable on 190 subjects from one area). The first grade subjects were all students taken from entire classes.

The classroom sizes ranged from twenty-eight (28) to eight (8) students per class, with a mean class size of 20.00. The various geographic regions were randomly selected by investigator location, subject accessibility and school district participation. Data such as CA, MA and IQ's were not obtained for the sample, because all of the subjects had met their respective school district and state criteria for entry into the first grade. The PMRT had been developed to be administered to entering first grade students.

Procedure

The PMRT was group administered to all of the subjects during the fall semester. The first grade subjects were all from within the aforementioned four state geographic regions. They were all administered the PMRT by their classroom teachers. The teachers were given the directions that outlined exactly how to administer the test to their class. The administration directions were all verbal, quite simple and required only a minimum amount of time to complete each item. The PMRT was administered to the entire first grade class and usually required about fifteen (15) minutes to complete. The tests were then returned to the investigators for scoring purposes.

The mentally retarded subjects were all in special EMR classes within one midwestern metropolitan area. The students records had been searched to find mentally retarded subjects who met the criteria specified for the study. A total of 193 mentally retarded subjects were found who met the specified criteria. Undergraduate special education students from a midwestern university were trained on the administration procedures of the PMRT. Although the PMRT was designed to be group administered, it

had been decided by the investigators to limit the group size for the mentally retarded subjects. The final decision was to administer the test to the mentally retarded subjects in groups of two or three subjects. This procedure assisted the test administrator who would give the verbal instructions and observe each subject as he or she completed the required tasks for the test. Thus, the test administrator could be certain that each subject was completing the designated items in the PMRT sequence. Each test administration group took approximately fifteen minutes.

In May of the following spring semester each of the subject's classroom teachers (first grade and special EMR classes) were asked to rate their students' mathematical ability relative to the other students within their class. The teachers were provided with a cover letter which explained the rating sheet with each subject's name typed beside a seven-point scale. The rating scale was from low (1) to high (7) in mathematical ability. The teacher's ratings of each subject's mathematical ability was assumed to be indicative of the subjects mathematics achievement during that school year. Two teachers failed to return the rating information which accounted for the attrition of eighteen mentally retarded subjects.

Statistical Analysis

The statistical analysis involved a comparison of the first grade and mentally retarded subject's mathematics ability as rated by their classroom teacher.

This analysis was accomplished by:

(1) Comparison of overall mean scores for the two samples utilizing a Student t-test for independent samples (Edwards, 1968, p. 88).

(2) Comparison of each sample's rating by utilizing chi-square statistics (Siegel, 1958, p. 104).

(3) Comparison of each sample's rating by percentage.

(4) Comparisons of teacher's rating per classroom size.

Results

In the initial PMRT study (Richardson et al., 1977), the overall results had indicated a significant difference between the mean scores on the teacher's ratings for two samples. A Students t-test for independent samples (Edwards, 1968) was performed to find the overall difference. That analysis produced a significant t score ($t = 5.81$, $p < .01$).

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Insert Table 1 about here
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In an effort to determine where the differences occured, the second phase of the analysis involved comparing the individual rating scores of the two samples. A chi-square analysis (Siegel, 1958) was performed to find the individual differences between the samples. The analysis produced an overall significant chi-square ($\chi^2 = 33.44$, $df = 6$, $p < .0001$). The individual comparisons found observed score differences between the mentally retarded and first grade subjects at both the high and low ends of the rating scale. Of particular interest, were the sample trends as indicated by the analysis. The observed first grade subjects had less than expected subjects scoring in the lower rated numbers and more than expected subjects in the higher rated numbers. The trend for mentally retarded subjects was just the reverse. That is, the observed patterns were that more than expected subjects scored in the lower rated numbers, while less than expected subjects scored in the higher rated numbers. Table 1 had indicated that both samples had scored within the entire range of rating numbers (1-7). The difference found in the two samples were in the number of subjects accounted for by each of the ratings. The results of this analysis are shown in Table 2.

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A further indication of the samples rating differences was found by comparing the percentages for both samples. As indicated on Table 3, the observed mentally retarded subjects percentages were higher on the lower ratings (1-2-3) and lower on the higher rated (5-6-7) scores. On the higher rating they had twelve percent of their total sample rated as five, eleven percent rated six, and six percent rated as seven in mathematics ability. Cumulatively, these three higher ratings accounted for 29 percent of the total mentally retarded sample. On the other hand, on the lower ratings they had fourteen percent of their total sample rated as one, seventeen percent rated two, and eighteen percent rated as three in mathematics ability. Cumulatively, the three lower ratings accounted for 49 percent of the total mentally retarded sample.

Conversely, the observed first grade subjects were rated just the opposite. On the higher ratings they had fifteen percent of their total sample rated as five, eighteen percent rated six, and fifteen percent rated as seven in mathematics ability. The cumulative percentage total for the first grade subjects rated at five, six and seven were 48 percent. While on the lower ratings, they had eight percent of their total sample rated as one, nine percent rated two, and ten percent rated as three in mathematics ability. Cumulatively, the percentage for the first graders on the three lower ratings amounted to 27 percent.

In comparing the two samples, the greatest disparity between percentages was found at the six and seven score for the higher ratings and

the two and three score for the lower ratings. In the higher (6-7) ratings, the first grade sample had a cumulative advantage of sixteen percentage points. In the lower (2-3) ratings, the mentally retarded sample had that same (16%) cumulative advantage difference. The rating of four was found to have been the only comparable percentage for both samples. It was found to contain twenty-three percent of the total first grade sample and twenty-two percent of the total mentally retarded sample.

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Insert Table 3 about here
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The data was then analyzed by the number of mentally retarded subjects within each classroom. As indicated prior, there was not one EMR classroom in this study that was entirely composed of subjects because of the selection criteria. All of the first grade subjects had been taken from complete, intact classrooms. Thus, the EMR teachers rated the students in the classrooms that had satisfied the selection criteria; they rated between one (1) and thirteen (13) subjects with a mean number of 3.84 subjects in their class. The results of that analysis is presented in Table 4.

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Insert Table 4 about here
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As previously reported within the procedure section, the teacher's rating scale ranged from a low of one (1) to a high of seven (7). The average teacher's rating for this scale would have been a score of four (4). The results of Table 4 have shown that the only above average mean teacher's ratings were obtained in classrooms that had six ($\bar{X}$ = 4.67), nine ($\bar{X}$ = 4.11) and ten ($\bar{X}$ = 5.10) subjects. These classrooms involved only four teachers and 31 mentally retarded subjects.

The other eight classroom sizes had mean rating scores which were below average. These mean rating scores ranged from a high of 3.92 (eight subjects per class) to a low of 2.00 (two subjects per class). These eight different classroom sizes had 41 teachers and 144 mentally retarded subjects.

The classroom sizes for the first grade sample ranged from a high of twenty-nine (29) to a low of nine (9) per class ($\overline{X}$ = 20.00) that the teacher's rated. The results of this analysis have shown that the only below average mean teachers rating was obtained in classrooms that had twenty ($\overline{X}$ = 3.60) students. These classrooms contained 60 subjects and three teachers. All of the other ten classroom sizes had ratings above the average score of 4.00. These mean rating scores ranged from a high of 5.09 (19 subjects per class) to a low of 4.16 (22 subjects per class). These ten different classroom sizes contained 677 first grade subjects and 31 teachers. The results of this analysis are shown on Table 5.

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Insert Table 5 about here
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Discussion

The results of this investigation have shown that the teachers of the mentally retarded consistently rated their students lower than their first grade counterparts. The question is why? In an attempt to answer this question, or at least to explore possible alternative reasons for such differences, the results were discussed in regard to the limitations of the study.

One limitation was involved with both the use of a rating scale and the rating criteria. Previous research (Beers, 1973; Thurman, Richardson

& Bassler, 1976) with the PMRT had indicated that the teacher's rating of each individual student's mathematics abilities was the essential criterion measure for validating the predictability of their PMRT score. That is, it was assumed that the teacher's rating would be a valid measure of a student's mathematics grade. So, if the student's rating and their PMRT score were correlated, then the PMRT score could be counted upon to reliably predict a student's potential mathematics function. Prior research (Beers, 1973; Thurman et al., 1976) had found that the PMRT could reliably predict about 70 percent of the students who would need mathematics remediation.

Chansky (1964) has stated that grades mean different things to different teachers. Some see grades representing discrete categories, while others see grades as relative ordering of achievement. Rating scales, while generally a convenient method to estimate grade quality, are subject to errors. According to Good & Brophy (1977) rating scales have the following drawbacks: (a) forces the rater to make a qualitative judgement, (b) difficult to rate performance dimensions separately, and (c) subject to halo effect[2] errors. Such factors could have been instrumental in the results of this study. Indeed, their impact and importance were increased when the specified rating criteria of this study was reflected upon. The only rating criteria given the teachers involved instructing each of them to rate their individual students mathematical abilities to the other students in the class/subgroup on the rating scale of one (low) to seven (high). Other, extraneous variables such as curriculum, achievement-norms, experiences, age-differences, etc. were not controlled for or taken into account. The specified criteria was very open-ended and subject

beginning the first grade. It had been assumed by the investigators that the mental age criterion would provide a comparable sample of EMR subjects that were ready to begin first grade mathematical concepts. Unfortunately, the variables of chronological age and curriculum involvement was not taken into full account. The mental age requirement caused a chronological age differential between the two samples. The EMR subjects chronological age was much older ($\bar{X}$ = 10- years) than their first grade counterparts. It is conceivable that the older children have had more developmental experiences which could contaminate the variable of mental age for readiness skills. Also, and more importantly for this study, the factor of teacher tolerance would become more influencial as chronological age increases. In other words, teachers might be more tolerant of younger children who have had less experiences in which to shape their behavior. Thus, this sampling limitatior could have resulted in some halo effect errors. As for curriculum, the investigators assumption was that the MA criterion would allow for EMR subjects who were ready to begin first grade mathematics concepts. This assumption did not take into account the fact that the curriculum revolves around the teacher. It was conceivable that even though the EMR subjects mentally were at the mathematics readiness stage, that did insure that the teachers mathematics curriculum was aimed at that level. So, as mentioned prior, it is important that specific rating criteria be established that accounts for curricular differences.

Another category involving sampling was the class size differences. As indicated in the results section, the first grade subjects were represented by 34 entire classrooms. The EMR subjects were subgroups of 45 different classrooms. Therefore, it appeared as if the teachers of the

mentally retarded sample had a more difficult task in rating their students mathematical abilities than did the first grade teachers. The reasons for these difficulties revolved around curriculum and teaching style. In other words, the teachers of the EMR subjects would (most likely) be teaching a wide range of mathematical skills to different individual students or within small group settings. Conversely, the first grade teachers would (most likely) be teaching the same mathematics curriculum to the entire class at the same time. Thus, it would seem less difficult to rate an entire class over the same curriculum area, than to rate selected individuals within a class over numerous curricula.

A final limitation was in the test administration. The first grade teachers were given instructions and administered the PMRT to their respective classes. The selected EMR subjects were administered the PMRT in small groups by trained university students. The size of the group administered the PMRT was not seen as an important difference. What might have been a more important difference was the teacher's involvement (or lack of involvement) in the administration of the PMRT. The first grade teachers involvement with the adiminstration enabled them to have more information concerning this investigation. If for no other reason, the responsibilities of administering a mathematics readiness test in the fall and then rating each students mathematical abilities in the spring would have had a subconscious effect. Because of their lack of involvement with the PMRT administration, the teachers of the EMR subjects were seen as having been less priviledged with information. Thus, it would appear this factor may have also been instrumental in the teacher rating differences.

In conclusion, teacher expectancy biases are empirical fact. Yoshida & Meyers (1975) have reported that expectancy biases may be based more

upon teachers personal observations than a label given a student. Others (Brophy & Good, 1970; Good & Brophy, 1972) have suggested that the teacher's experience with children as well as their evaluation of individual students are more important for expectancy biases than an assumption regarding the students learning potential based upon an abstract deviancy label. This investigation has focused upon a difference in teachers ratings between first grade and mentally retarded children. During the last decade it has become fashionable to critize institutions. Teachers and school systems have been blamed for much of our present societal difficulties. While these criticisms have caused morale difficulties, they also have redeeming social value. The primary value of such criticisms has been a new consciousness and avareness of teachers treatment toward all children. Without drawing any conclusive answers concerning expectancy biases, this study has shown that the differences in teachers ratings could have resulted from other factors. However, most of these other factors did involve the teacher. While this investigation has not proven that teacher expectancy biases existed, it has neither disproven that fact. Future research should continue to investigate this phenomena of teacher expectations particularly within the natural setting of the classroom. If for no other reason, investigations involving teacher expectancies should cause educators to reexamine their conscience and strive to become as "objective" as possible in their classroom behavior.

TABLE 1

Mean and Standard Deviation Results of the

Teacher Rating's for the Samples

Sample	N	RATING RANGE Low ---- High	Mean	sd	t
Mentally Retarded	175	1 ---- 7	3.58	1.74	
					5.81**
First Graders	737	1 ---- 7	4.44	1.83	

** $p < .01$ level of significance

TABLE 2

Chi-square Results for Teacher

Ratings by Sample

	First Grade Sample			Mentally Retarded Sample			Totals		
Rating	Obs.*	Exp.*	χ^2	Obs.*	Exp.*	χ^2	Obs.*	Exp.*	χ^2
1	63	70.31	0.76	24	16.60	3.20	87	87	3.96
2	69	80.00	1.51	30	19.00	6.37	99	99	7.89
3	77	87.28	1.21	31	20.72	5.10	108	108	6.31
4	160	165.66	0.00	39	39.34	0.00	205	205	0.00
5	113	109.10	0.14	22	25.90	0.59	135	135	0.73
6	135	124.45	0.89	19	29.55	3.77	154	154	4.66
7	114	100.21	1.90	10	23.79	8.00	124	124	9.90
TOTALS	737	737	6.42	175	175	27.02	912	912	33.44**

** $p < .0001$

* Observed -- Expected

TABLE 3

Percentage's for Teacher

Rating by Sample

	First Grade Sample		Mentally Retarded Sample		Totals	
Rating	Observed	%	Observed	%	Observed	%
1	63	8	24	14	87	22
2	69	9	30	17	99	26
3	77	10	31	18	108	28
4	160	23	39	22	205	45
5	113	15	22	12	135	27
6	135	18	19	11	154	29
7	114	15	10	6	124	21
Totals	737	100	175	100	912	200

TABLE 4

Mean Results of Teacher's Rating for

Mentally Retarded Subjects per Classroom size

Number of Teachers	Number of Subjects Per Class	$\bar{X}$ Rating Score
10	1	3.40
6	2	2.00
9	3	3.77
6	4	2.96
4	5	3.15
2	6	4.67*
2	7	3.29
3	8	3.92
1	9	4.11*
1	10	5.10*
1	13	3.69
45	175	3.58

* Above the Average Score (Average Score = 4.00)

TABLE 5

Mean Results of Teacher's Ratings for

First Grade Subjects per classroom

Number of Teachers	Number of Subjects Per Class	$\bar{X}$ Rating Score
1	9	4.33*
1	13	4.54*
1	15	4.93*
2	18	4.75*
4	19	5.09*
3	20	3.60
3	21	4.69*
3	22	4.16*
6	23	4.24*
5	25	4.52*
3	26	4.18*
2	29	4.86*
34	737	4.44

* Above the Average Score (Average Score = 4.00)

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Footnotes

1. For a complete description and historical development of the Peabody Mathematics Readiness Test, readers are directed to:

   Thurman, R.L., Richardson, L.I. and Bassler, O.C., Peabody Mathematics Readiness Test: Rationale and philosophy historical development and utility with mentally retarded children. Paper presented at the 54th annual international conference of the Council for Exceptional Children, Chicago, Illinois, April, 1976. RIE , September, 1976; Exceptional Child Education Abstracts, 1976, Vol. 8, No. 4, (Ed 122 524).

2. According to Good & Brophy (1977):

   "A halo effect refers to the tendency to rate or evaluate a person or his performance on the basis of a global impression rather than upon the basis of a specific trait or performance" (p. 449).